

A SYSTEMATIC ARRANGEMENT OF THE FAMILIES OF THE DIPTERA.

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The first attempt at classifying the Diptera into higher groups than genera was made in the year 1802 by Latreille, who recognized and named twelve families, but did not classify these into higher groups. In 1805, however, in a later volume of the same work, he divided the Diptera into two primary groups, to which he applied the terms Section Première and Section Seconde. The latter is equivalent to the modern families Hippoboscidae and Nycteribidae. The first section he subdivided into Division Première (equivalent to the Nemocera of the present day) and Division Seconde.

In 1809 Latreille applied the term Proboscidea to his Section Première, and subdivided his Section Seconde into two groups, which he named Eproboscidea and Phthiromyia, equivalent to the modern families Hippoboscidae and Nycteribidae, respectively. In these three groups he arranged the sixteen families.

In 1825 Latreille reverted to his original classification, containing only two primary groups, and subdivided the first into the four following groups: Nemocera, which is the same as at present recognized under the same name; Tanystoma and Notacantha, which together are equivalent to the Orthorhapha Brachycera; and Athericera, equivalent to the Cyclorhapha with the exclusion of the Hippoboscidae and Nycteribidae.

Macquart, in 1834, recognized only two primary groups, the Nemocera of Latreille, and the Brachycera, which included all of the other Diptera. He employed the same classification in 1838.

Westwood, in 1840, adopted Latreille's classification of 1825, together with Macquart's name Brachycera, under which he placed the Notacantha, Tanystoma, and Athericera of Latreille.

Walker, in 1848, adopted the two primary divisions founded by Latreille in 1805, which he designated suborders.

Haliday, in 1851, also adopted these two divisions, and subdivided the first into three groups, the Nemocera of Latreille; Brachycera, equivalent to the same group of Macquart with the exclusion of the family Phoridae; and the Hypocera, which contained the Phoridae.

Loew, in 1862, adopted Macquart's classification, except that he separated from the Brachycera the families Hippoboscidae and Nycteribidae as a third primary group.

Brauer, in 1863, divided the Diptera into two primary groups, the Orthorhapha, which included the Nemocera, Tanystoma, and Notacantha of Latreille's classification of 1825, and the Cyclorhapha, comprising the Athericera of Latreille, together with the families Hippoboscidae and Nycteribidae.

Schiner, in 1864, adopted Brauer's two primary divisions, subdivided the first into two groups, the Nemocera of Latreille, and Brachycera of Macquart, which he thus limited to its present condition. The latter group he further subdivided into two groups, the Cyclocera, which contained the modern families Stratiomyidae, Tabanidae and a part of the Leptidae; and the Orthocera. The Cyclorhapha he subdivided into two groups, the Proboscidea and Eproboscidea, the latter comprising the families Hippoboscidae and Nycteribidae. The Eproboscidea he also subdivided into two groups, the Hypocera, containing the family Phoridae, and the Orthocera, a term which, curiously enough, he had already applied to a previous group in the Brachycera. The Orthocera he subdivided into the Oligoneura, which comprised the Muscoid Diptera; and the Polyneura, comprising the families Syrphidae, Conopidae, Pipunculidae and Platypezidae. The family Lonchopteridae he could not locate in any of these groups.

Osten Sacken, in 1878, adopted Brauer's two divisions, except that he separated out the families Hippoboscidae and Nycteribidae as a third primary group.

Van der Wulp, in 1877, adopted Brauer's two divisions, but in 1896 he followed the classification proposed by Osten Sacken.

Williston, in 1896, also adopted Brauer's two primary groups.

In 1883 Brauer elaborated his previous classifications, divided the Orthorhapha into the Nemocera and Brachycera as limited by Schiner, subdivided the first into three tribes, the second containing the family Cecidomyidae, the third tribe composed of two subfamilies of the Tipulidae, the other subfamily, together with the remaining eight families, forming the first tribe. The Brachycera he also divided into three tribes, the first composed of the family Lonchopteridae, which he placed between the families Tipulidae and Stratiomyidae, the third tribe formed of the families Empidae and Dolichopodidae. The Cyclorhapha he divided into two sections, the first of which was subdivided into two tribes, containing the Syrphidae and Pipunculidae in one, and the Phoridae and Platypezidae in the other; the second section also contained two tribes, the first divided into the Calyptrata as one group, the Acalyptrata and the family Conopidae forming another; the second tribe comprised the families Hippoboscidae and Nycteribidae.

These various attempts at classifying the Diptera into natural groups

have not yielded altogether satisfactory results. The impossibility of indicating natural relationship by a linear arrangement is, of course, well understood. The following arrangement, which is a modification of the systems of Latreille and Schiner, with suggestions of Osten Sacken and Williston, will, it is believed, serve to indicate the natural relationships of the various families in a clearer manner than any of those that have been thus far proposed:

Suborder Proboscidea Latreille.

Section Orthorhapha Brauer.

Subsection *Nemocera* Latreille.

Superfamily *Tipuloidea* Coquillett.

Families: 1 Tipulidæ, 2 Dixidæ, 3 Culicidæ, 4 Psychodidæ, 5 Stenoxenidæ, 6 Chironomidæ, 7 Cecidomyidæ, 8 Mycetophilidæ.

Superfamily *Bibionidea* Coquillett.

Families: 9 Bibionidæ, 10 Simulidæ, 11 Orphnephilidæ, 12 Blepharoceridæ, 13 Rhyphidæ.

Subsection *Brachycera* Macquart.

Superfamily *Tabanoidea* Coquillett.

Families: 14 Leptidæ, 15 Stratiomyidæ, 16 Acanthomeridæ, 17 Tabanidæ, 18 Acroceridæ, 19 Nemestrinidæ.

Superfamily *Bombyliidea* Coquillett.

Families: 20 Apioceridæ, 21 Mydaidæ, 22 Bombylidæ.

Superfamily *Asiloidea* Coquillett.

Families: 23 Scenopinidæ, 24 Therevidæ, 25 Asilidæ, 26 Empidæ, 27 Dolichopodidæ.

Superfamily *Phoroidea* Coquillett.

Families: 28 Lonchopteridæ, 29 Phoridæ.

Section Cyclorhapha Brauer.

Superfamily *Syrphoidea* Coquillett.

Families: 30 Platypezidæ, 31 Pipunculidæ, 32 Syrphidæ, 33 Conopidæ.

Superfamily *Muscoidea* Coquillett.

Group *Calypteratæ* Desvoidy.

Families: 34 Oestridæ, 35 Tachinidæ, 36 Dexidæ, 37 Sarcophagidæ, 38 Muscidæ, 39 Anthomyidæ.

Group *Acalypteræ* Macquart.

Families: 40 Scatophagidæ, 41 Heteroneuridæ, 42 Helomyzidæ, 43 Phycodromidæ, 44 Sciomyzidæ, 45 Sapromyzidæ, 46 Lonchæidæ, 47 Ortalidæ, 48 Trypetidæ, 49 Micropezidæ, 50 Sepsidæ, 51 Psilidæ, 52 Diopsidæ, 53 Ephydridæ, 54 Oscinidæ, 55 Drosophilidæ, 56 Geomyzidæ, 57 Agromyzidæ, 58 Borboridæ.

Suborder Eproboscidea Latreille.

Families: 59 Hippoboscidæ, 60 Nycteridæ.

The Eproboscidea differ in so many important particulars from the remaining families—such as the method of reproduction, manner of living, much tougher integument of the body, structure of the proboscis and of the antennæ—as to justify their separation into a group equivalent to all of the other Diptera. Between these two divisions there are no intermediate forms. This is the position first assigned them by Latreille, and in this he has been followed by Meigen, Westwood, Walker, Haliday, and Bigot, while Loew and Osten Sacken make them one of three primary groups.

In the present arrangement the Tipulidæ are placed first in the list, since they are evidently the lowest, most generalized of all the Diptera; their comparatively large size, elongated form, weak organization, numerous, many-branched veins, and long, many-jointed antennæ all tend to confirm this supposition. The Mycetophilidæ are placed at the opposite end of the first superfamily for the reason that in several forms the legs, and especially the antennæ, are comparatively short and robust, thus approaching the members of the second superfamily; thus the genera *Platypura* and *Hesperinus* approach very close to *Plecia*, in the Bibionidæ, which begins the second superfamily. The genus *Rhyphus* is closely related to *Rhachicerus*, in the Leptidæ, for which reason the Rhyphidæ are placed at the end of the second superfamily, while the Leptidæ begin the third. The latter, the Tabanoidea, are bristleless flies, further distinguished from the two following superfamilies by the greatly widened empodia; the genus *Pangonia*, in the Tabanidæ, with its unusually large calypteres, frequently elongated proboscis and reported habit of hovering over flowers, like a humming-bird, naturally connects with the genus *Eulonchus*, in the Acroceridæ; and the relation of the latter to the Nemestrinidæ is a rather close one. The members of the following superfamily, the Bombylioidæ, are usually more or less bristly, and are essentially flower-visiting flies among which the habit of hovering over flowers is of rather frequent occurrence, while the singular course of the veins in the apical part of the wings of many serve still further to connect them with the Nemestrinidæ. The Asiloidea are usually provided with stout bristles and are almost without exception predaceous, the habit of hovering over flowers being unknown.

The family Lonchopteridæ is retained in the Orthorhapha, notwithstanding the fact that de Meijere, from a recent study of the early stages of *Lonchoptera lutea*, while admitting that the family is in many respects intermediate between the Orthorhapha and Cyclorhapha, concludes that it has slightly more relationship with the latter than with the former. In *Lonchoptera*, however, there are four posterior cells in each wing, while the Cyclorhapha never have more than three of these cells; in the Orthorhapha Brachycera and in the Nemocera with a discal cell the possession of more than three posterior cells is

the rule rather than the exception. Moreover, the position of the antennal arista is apical in *Lonchoptera*, while in the Cyclorhapha it is with few exceptions dorsal, but in the Orthorhapha Brachycera its position is almost without exception apical. The presence of stout bristles likewise indicates a relationship to the Asiloid rather than with the Syrphoid forms. For these and other reasons that might be cited the relationship of the Lonchopteridae is evidently with the Orthorhapha rather than with the Cyclorhapha.

The form of the head, with the stout, reclinate frontal bristles, as well as the apical position of the antennal arista and the bristly body of the Phoridae, indicate a rather close relationship with the preceding family; the agile movements of the Phoridae, their disinclination to take to their wings when disturbed, together with the presence of bristles, ally them with the Dolichopodidae rather than with the Syrphoid group, with which they have sometimes been associated. The venation of the Phoridae is difficult of interpretation, but there are evidently three posterior veins, which would indicate the presence of four posterior cells, and this would exclude this family from the Cyclorhapha and would naturally indicate still more clearly its relationship with the Lonchopteridae and the remaining families of the Orthorhapha Brachycera.

The Phoridae naturally lead to the usually bristly Platypezidae, which is accordingly placed at the beginning of the next superfamily, the Syrphoidea, which differs from the Muscoidea in the greater development of the anal cell, which is always present and usually much longer than the second basal; moreover, they are very seldom provided with macrochaetae, which so often occur in the latter group. The relationships existing between the families are so apparent as to need no further mention.

Girschner was the first to point out the fact that *Calliphora* and several other genera, which had hitherto been placed in the Muscidae, have a perpendicular row of bristles on the hypopleura, as in the Sarcophagidae, Dexidae, and Tachinidae, while *Musca* and several other genera, like the Anthomyidae, do not have them. Accordingly, Pandelle has very properly removed to the Sarcophagidae the genera with hypopleural bristles; thus the more robust forms with strong bristles are brought together, while the weaker ones with weak bristles are retained in the Muscidae, a far more natural arrangement than the one heretofore in use.

The introduction of superfamilies in the present arrangement is for the purpose of more nearly bringing the classification of the Diptera into harmony with that of the other departments of zoology. Among entomologists, Dr. Uhler appears to have been the first to employ them, and more recently they have also been used by Mr. Ashmead in his admirable classification of the Hymenoptera. The superfamilies

Tipuloidea and Bibionoidea correspond to Osten Sacken's recently proposed divisions, *Nemocera vera* and *Nemocera anomala*, respectively, while the Tabanoidea are equivalent to his *Eremochaeta*, with the addition of the families Acroceridae and Nemestrinidae.

Osten Sacken, to whom the science owes so much in bringing about a more rational arrangement of the Orthorhapha, has suggested the merging of the old families, Xylophagidae and Coenomyidae, with the Leptidae, a suggestion since put in operation by Dr. Williston; the three groups appear to be altogether too closely related with each other to be maintained as distinct families.

The recently proposed family, Eretmopteridae, of Kellogg, does not appear to be sufficiently distinct from the family Chironomidae to be maintained; it was founded on a degraded form related to the genus *Chasmatonotus* Loew, but apparently more closely related to the short-winged genus *Smittia* Holmgren, from Spitzbergen, both of which have been referred by their authors to the Chironomidae.

Pupipara is a later term for, and therefore a synonym of, Eproboscidea.